Some New Approaches to Studying Space Weathering Preliminary Results from the Visible to Mid-IR. K. Slavicin ska, B.C. Ferrari, A. LeBlu-DeBartola, R. Havel, R. Cantelas, and C. J. Bennett, Department of Physics, University of Central Florida (UCF), Orlando, FL. 3Center for Lunar and Asteroid Surface Science (CLASS), University of Central Florida, 4Radiation Effects on Volatiles and Exploration of Asteroids and Lunar Surfaces (REVEALS), e-mail: christopher.bennett@ucf.edu

Introduction: There is a great deal of interest to study the process of space weathering, which refers to how the surfaces of airless bodies (such as the Moon, and asteroids) are altered by their exposure to the space environment. Here, thermal cycling, Solar and Galactic UV/X-ray photons, the Solar wind, Galactic Cosmic Radiation, and micrometeoroid impacts all modify the surfaces of these bodies. For many years, both observations and laboratory data have studied these interactions primarily in the visible range, where the effects of space weathering were synonymous with lowering the albedo, spectral reddening, and lowering of band depths. However, recent studies – particularly on carbonaceous chondrites have shown that different trends can occasionally be observed when different radiation sources, different meteorites, or different spectral ranges are considered. Few systematic investigations have been performed to date, especially under UHV conditions.

New Chamber Design: In collaboration with CLASS and REVEALS, we have designed a novel ultra-high vacuum (UHV; <10⁻⁹ torr) chamber which is specifically tasked to conduct space weathering experiments on soils/powders, slabs, as well as mixtures of volatiles condensed on these surfaces held at temperatures as low as 10 K. The overall design of the chamber is shown in Figure 1. Briefly, a cryostat holds a powdered sample within a central region that can be exposed under UHV conditions to temperatures from 10-1000 K, radiation from UV photons and energetic electrons while collecting spectra in diffuse reflectance mode (cf. NASA’s RELAB facility).

Suitable Background: Generally, sintered Teflon targets are utilized for VIS-NIR spectral measurements, while diffuse gold is chosen from the NIR-midIR range. We have investigated the suitability of several standards to cover the entire spectral range (silver, aluminum, and rhodium), which we will briefly discuss here.

Preliminary Weathering Data: We present some preliminary spectra on olivine, and two CLASS simulants (lunar highlands and a Cl simulant based on the Orgueil meteorite) in their pristine form, as well as subjected to a simulated space-weathering environment (here, a reduced hydrogen atmosphere at 4500 °C). These results are shown in Figure 2. In all cases we observe reduced albedo over the entire spectral range, and flattening (or omission) of most of the absorption bands, but the change in slope is found to be highly dependent on the spectral region that is investigated.